Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Proposed Changes in the Commission's	)	ET Docket 01-137
Rules Regarding Human Exposure to	)	
Radiofrequency Electromagnetic Fields	)	

Reply Comments of

APREL Laboratories and Spectrum Sciences Institute

Background

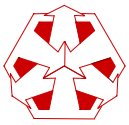
APREL Laboratories (www.aprel.com) is an independent research, engineering and accredited testing organization in telecommunications, established in 1981, and active in the field of RF Safety and SAR/Dosimetry since 1995. APREL personnel participate actively in setting of measurement methodology standards, holding executive positions in several groups (see www.aprel.com/standards). APREL is the manufacturer of the leading-edge ALSAS 10U Integrated SAR Measurement System, a fully compliant dosimetric and HAC test system, which is based on APREL's research and engineering work in this field.

Spectrum Sciences Institute (www.spectrum-sicences.org) is an independent, not-for-profit research organization, dedicated to wireless telecommunications technologies. It carries out multi-stakeholder research and information dissemination activities, and has MOU's with other research organizations. Its advisory board spans 3 continents.

APREL Laboratories in conjunction with Spectrum Sciences Institute have reviewed comments submitted to the FCC by interested parties, referencing **RF Safety NPRM ET Docket No. 03-137** and would respectfully like to provide the following additional (reply) comments.

Some General Comments/Conclusions

1) In general we agree with and applaud the Commission's efforts and the position of industry that it is good to simplify the process for proving compliance with the current rules, and proposed rule changes. This should not be carried out purely in the interest of getting products to the marketplace but must be done so as to get quality, compliant products to the marketplace, which have been assessed in such a way as to prove compliance within the appropriate application and user scenarios of any given product. Elimination of product recalls due to grant withdrawal must be the goal for the Commission and this can only be achieved by changing rules in such a way that due diligence is shown when a manufacturer assesses a new product for compliance with the rules.



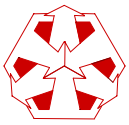
2) It must be taken into account that the data from products which have been filed with the FCC (or with TCB's), and which therefore resides in the FCC's filings database by definition represents only compliant products (essentially, "best case"). Consequently, any changes to the current regulations and rules must *not* be based on solely on the experience from such products which have already been awarded a grant. Many products evaluated in the laboratory, whether at the design or at the compliance test level, fail to meet the limits for RF exposure (particularly SAR). In some cases, such failures are very substantial (in multiples of the limits, not fractions). Failing data is not submitted to the regulator; instead, the products are normally redesigned for compliance. This has to be one of the fundamental objectives of a healthy regulatory system. Considerations must therefore be made in respect to development cycles, along with methods employed to change product compliance status so as to achieve the requirements for grant. Further consultation with manufacturers along with laboratories executing analysis on products must be made by the FCC.

3) Globally standards development continues to be underway, with extensions to frequency requirements and other considerations constantly being updated, and it may be unfair on the public, manufacturers, FCC, and laboratories to incorporate methodologies for proving compliance solely on the basis of work in progress (often un-reviewed and non-consensus) for standards and research. It seems particularly inadvisable to base exemptions on such early work.

4) On the other hand, there is a need to incorporate flexibility in the approach to methodologies employed by regulators to assess conformity of any given device. As technology changes so should the scientific approach in assessment. More time must be given to the scientific community so as to define, create, and develop principles and practices for assessment of a given product type. Considerations must be made when basing new rules on IEEE-1528 (incorporated in the FCC's rules) for technologies not covered by the standard, and as such a more diplomatic way in how new technology is perceived, and assessed to prove conformity to regulatory requirements should be adopted. Historically IEEE 1528 had a scope founded in assessment of cellular transceivers, (like many of the global standards) and it has now been proven that some of the methodologies for assessment may not be entirely sufficient for the evaluation of products operating above 3GHz. Consider products which have multiple transceivers operating with separate modulation schemes, at multiple frequencies, located on the same planner board. No provisions exist currently for the assessment of these devices, and many proposals have been made for the assessment of said products. It is possible that a forced decision on the methodology be made and thus chain industry to this, which in the long term may not be suitable for these types of products. More time, and more research, are needed to create sound scientific methodologies for these types of assessments.

5) Notwithstanding the above, and to the extent that international standards are incorporated into the FCC's rules, it must be recognized that they do represent substantial international R&D and development efforts. It is therefore necessary to ensure that the measurement tools used by first and third party laboratories are compliant with these standards, and with the FCC's stipulated methodologies. This includes such aspects of the measurement systems as validation and verification, uncertainty assessment, calibration methodologies, tissue simulants, standardized, horizontally-oriented phantoms which allow the proper assessment of SAR (including the ability to "tilt" the probes to ensure that boundary effects estimation and probe positioning are both correct when measurement angles would otherwise be too acute), and many other factors.

6) A need has been shown by industry and scientific/engineering organizations for the FCC to specify documentation necessary for the support of test processes employed by a body while assessing products for conformity to the regulations (i.e. antenna configurations, types, electrical



characteristics). Currently the rules which are in place can place institutions, laboratories, and even manufacturers at disadvantage for lack of fully consistent and consistently treated information a laboratory or institution assessing a product for conformity, and due to the way in which the rules can be perceived by a manufacturer. It will be of great benefit to codify what and when the required documentation and measurements needed to support a grant application shall really be (even if erring on the side of consistent conservatism). This is true not only for the application post test, but in the pre test evaluation process, and there would be value in putting in place a set of guide lines/rules for manufacturers who use second/third parties for product assessment. These documentation requirements are necessary not only for the FCC or TCB who review applications, but for the laboratory and or institution who will assess the product for conformity. If the FCC adopt a strong stance on this it will ensure products are assessed in line with the requirements for the grant award, keep a more level playing field for all manufacturers, and could lower the post grant audit burden.

100 mW Exclusion

In respect to the proposed exclusion for transmitters operating below 100mW, we disagree with the view recorded by many of the commenting parties, and respectfully submit that this is not a tenable position. Some of the comments of our colleagues support this view also.

Firstly, it is known that SAR is not wholly dependent on power, an assumption that is of necessity part of the basis of the proposed exclusion. Considerations must be made in respect to the frequency that is being assessed, as well as many other factors in the design of the device. This was clearly shown in the FCC's paper presented at BEMS (Cleveland et al, 2003).

As an illustration, Table 1. below has been derived from the current IEEE 1528 standard utilizing target values for a SAR system validation, for dipole antennas positioned at distances of 15mm <1GHz and 10mm >1GHz.

Conclusions are thus

- A 100mW exclusion would in part contradict the principles of IEEE 1528
- SAR could be expected to increase or decrease with changes to the frequency
- 100mW exclusions could never apply to transceivers operating above 1GHz
- It is accepted that SAR is linear for any given specific scenario (product), and as such linear scaling has been used in Table 1. below
- SAR from 1GHz onwards can increase by up to a factor of 6x for a simplified filament
- Using a simplified resonator, it can is shown that a value of 20.8mW power will still cause a product to fail the FCC requirements
- For real devices, it is no longer possible to assume that high-gain antennas will not be used - this was mostly true with true compact, portable devices, mostly due to battery life considerations. In today's devices, particularly IT equipment which may have large battery capacity, or which may transmit while mains-connected, integrators or manufacturers may use high gain antennas. It is therefore necessary to set both a conducted and radiated threshold for any possible exemptions.
- Complicated filaments hosted within a complex structure with poor matching can yield even higher SAR numbers and as such a more realistic and appropriate exclusion would therefore be in the region of 2.5mW, conducted power, AND 30 mW radiated (note that both boundary conditions would have to be satisfied), particularly for higher frequency devices.

Frequency (MHz)	1 g SAR	1g SAR Normalized to 100mW	Power at FCC Limit 1.6Wkg (mW)
300	3.0	0.3	x
450	4.9	0.49	x
835	9.5	0.95	x
900	10.8	1.08	x
1450	29.0	2.90	55.0
1800	38.1	3.81	42.1
1900	39.7	3.97	40.3
2000	41.1	4.11	39.0
2450	52.4	5.24	30.7
3000	63.8	6.37	25.1
5200	76.1	7.61	20.8
5800	67.6	6.76	23.6

Table 1.

NOTE:
Column 3 is SAR normalized to 100mW
Column 4 is Power normalized to 1.6 W/kg in line with the FCC limit

In addition to its work in measuring various real-world devices and systems, APREL Laboratories have conducted a study where a simplified filament has been assessed for SAR at multiple frequencies where variations to the separation distance between the filament and the medium have been employed to assess the change to averaged SAR (Annex A Reference Papers). It was proven that a further increase in SAR of a factor of 2x can be expected.

Dependent on the geometric shape of the host, matched with active electronics which have separate electrical characteristics, along with the filament and associated matching characteristics, one can assume that taking the above into account an infinitely large increase factor could be assumed, and as such a simplified resonator assessed at 2.5mW conducted power with a SAR value of 0.16 W/kg can in easily increase SAR to a point greater than 1.6 W/kg when employed within a host, and changes to separation distance are made.

In respect to the other comments submitted under this subsection APREL are in agreement and will reiterate that further clarifications needs to be made from the FCC in respect to the terms, and definitions.

Multiple transmitters

APREL Laboratories are in agreement with the comments that adding evaluated SAR for each individual transceiver is unacceptable. It should be noted that methodologies contained within IEC standard 62209 are currently being developed and that these are suspect to change at a latter date, through further scientific research and development of engineering practices. It has been commented on at the start of this document that further time, is needed to fully assess and evaluate the engineering solutions to the co-located issue put forth by the FCC, and as such an open approach MUST be adopted by the FCC in any future rule making.

International Standards

APREL Laboratories are in agreement in principle with the proposal of inclusion of references to accepted international standards, i.e. IEC, IEEE et al, however other standards are in place, and are currently being employed for use in proving compliance, and as such, reference should be made to standards not only from these organizations but others, including internal processes and procedures created by organizations which have scientific merit (such as the status quo).

Duty Cycles

APREL Laboratories are in part agreement with the comments submitted by some parties in respect to allowances for a duty cycle to be accepted. However the comment only discusses 802.11b standard which covers the frequency band of 2.4GHz. No supporting statements have been made in respect to either 802.11g or 802.11a operating standards. As the 802.11 technology advances it is becoming more the norm to have multiple operating standards contained within one chipset wireless module and as such it is wrong to base future rules and guidelines on only the 802.11b standard. It has been discussed within this document the issues relating not only to power but frequency, and that an increase in measured SAR of up to 6x can be achieved when utilizing an 802.11a standard. **Table 2**. provides details of measurements made on a number of 802.11a/b modulation schemes, with correct SAR to a 10% duty cycle.

Operating Standard	Frequency MHz	Power mW	SAR W/kg	Normalized to 10% Duty Cycle
802.11b	2412	25	0.75	0.07
802.11b	2412	80	2.4	0.24
802.11b	2412	110	3.3	0.33
802.11a	5260	25	1.1	0.11
802.11a	5260	80	3.52	0.35
802.11a	5260	110	4.84	0.48

Configurations

Based on its research, APREL Laboratories disagree with the approach that one host e.g. laptop computer would be sufficient to prove conformity to the exposure requirements for a modular device integrated into multiple hosts, based on today's measurement methodologies and limits. The shape and form of the laptop is not the key element which contributes to the measured SAR value, but rather the frequency, type, and position of the antenna which can be internally located within the chassis of the laptop. In most cases it is not possible to pinpoint the location for the filament which has been internally housed within a laptop host. APREL Laboratories have assessed laptops with the same physical characteristics and form factor (same model) and found that SAR has INCREASED due to positioning of the internally located antenna, and as such a post audit of the grant conditions and processes could lead to recalls if a presumption of conformity is incorrectly made.

APREL Laboratories and Spectrum Sciences Institute do have additional reply comments in respect to this NPRM, which we respectfully request leave to file as late reply comments.

Submitted this day, January 6th, 2004,

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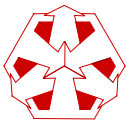

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